STRINGER AND STEP SUPPORT KIT FOR STAIRWAYS

FIELD OF THE INVENTION

The present invention relates to stairways and, more particularly, to modular stairways made of pre-fabricated components such as stringers, step supports, railings, etc., typically in the form of a kit for assembly on site.

BACKGROUND OF THE INVENTION

Typically, staircases are completely produced on site with the various wood components being cut to size as the staircase is progressively erected on site.

Also, it has been proposed to completely assemble a staircase in the factory such that a pre-assembled staircase is delivered to the construction site for direct and easy installation thereat. Such a modular staircase is disclosed in the Canadian Application No. 2,149,981 naming Raymond Couture as inventor and laid-open for public inspection on November 24, 1995.

Furthermore, in Canadian Application No. 2,276,988 also naming Raymond Couture as inventor and laid-open for public inspection on December 30, 1999, a modular staircase is proposed that includes a permanent framing made of metallic stringers and vertically extending step supports that are secured along the stringers. Each step support includes upper and front flanges adapted to be secured respectively to a tread and to a riser of each step of the staircase. If the staircase has a partly exposed side, various decorative or finishing wooden components, including treads, risers, false or decorative stringers, mouldings, etc., are provided to cover any exposed structural metallic framework and particularly the stringers.

Also, in the United States Patent No. 4,422,270 naming Leopold Lapoine and Donat Pelletier as inventors and issued on December 27, 1983, a modular, self supporting flight of stairs is proposed. The flight of stairs described therein comprises at least one pair of stringer units for supporting at least one tread thereon and bolted thereto, the stringer units each comprising a side plate and a fixation plate extending outwardly therefrom and parallel thereto for fixing a fixation of a first unit to a side plate of an adjacent

unit by riveting or bolting. A two-part stringer unit comprising intersecting oblong slots allows for step height adjustments.

Finally, in the United States Patent No. 2,593,683 naming G.W. Lyons as inventor and issued on April 22, 1953, a vertically adjustable staircase is proposed. The flight of stairs described therein comprises sectional stringers formed of prefabricated sheet metal tread-supporting plates, each plate comprising a vertical body portion, two vertical and parallel longitudinal flanges perpendicular thereto and a horizontal rectangular top flange for supporting a tread thereon and bolted thereto. One of the longitudinal flanges of a given plate comprises a plurality of sets of perforated holes for combining with a set of corresponding perforated holes in an adjacent longitudinal flange of an adjacent plate thereby providing adjustable fastening means therefor.

SUMMARY OF THE INVENTION

More specifically, in order to address the above and other drawbacks and in accordance with the present invention, there is provided a modular stringer for a staircase, the stringer comprising at least two matingly coupled step support units defining the stringer, said step support units each comprising a main structural body, a first mating structure extending substantially laterally from a first lateral side thereof and a second mating structure extending substantially laterally from an opposing lateral side thereof, said first mating structure of said step support unit being adapted to be matingly coupled with an adjacent second mating structure of an adjacent step support unit such that said adjacent unit is vertically offset therefrom.

Still in accordance with the present invention, there is provided a step support unit to be matingly coupled with at least one structurally similar adjacent step support unit such that said adjacent unit is vertically offset therefrom, the unit for the construction of a modular stringer for a staircase, the step support unit comprising a main structural body, a first mating structure extending substantially laterally from a first lateral side thereof and a second mating structure extending substantially laterally from an opposing lateral side thereof, said first structure comprising at least one mating

element and said second structure comprising at least one complementary mating element complementary to said mating element of said first structure and vertically offset therefrom.

Still in accordance with the present invention, there is provided a kit for erecting a staircase between an upper and a lower structure, the kit comprising at least two modular stringers each comprised of an equal number of step support units defining the stringers and a series of steps adapted to be mounted to said step support units, said step support units each comprising a main structural body adapted to support said steps thereon, a first mating structure extending substantially laterally from a first lateral side thereof and a second mating structure extending substantially laterally from an opposing lateral side thereof, within a same stringer said first mating structure of said units being adapted to be matingly coupled with an adjacent second mating structure of an adjacent unit such that said adjacent unit is vertically offset therefrom.

Still in accordance with the present invention, there is provided a modular stringer for a staircase, the stringer comprising at least two coupled free standing step support units defining the stringer, said step support units each comprising at least one shaft extending vertically at least partially along a first lateral side thereof and at least one coupling arm extending substantially laterally and horizontally from an opposing lateral side thereof, said coupling arm of a first step support unit being adapted for accepting and solidly retaining said shaft of an adjacent step support unit therein such that said adjacent step support unit may be vertically offset therefrom.

Still in accordance with the present invention, there is provided a kit for erecting a curling staircase lined by an outside structure defining an outside curl of said staircase, the kit comprising a modular stringer comprised of at least two modular step support units defining the stringer, a set of corresponding wall mountable step support units and a set of steps adapted to be mounted on said step support units, said modular step support units each comprising at least one shaft extending vertically at least partially along a first lateral side thereof and at least one coupling arm extending substantially laterally and horizontally from an opposing lateral side thereof, said coupling arm of said modular step support units being

adapted for accepting and solidly retaining said shaft of an adjacent modular support unit therein such that said adjacent modular support unit may be vertically offset therefrom.

Still in accordance with the present invention, there is provided a kit for erecting a staircase between two lining structures, the kit comprising at least two stringers adapted to be mounted to said lining structures and a series of steps adapted to be mounted to said stringers, each said step comprising a tread and a riser, the kit further comprising a plurality of step mounting brackets used to mount said treads and said risers to said stringers, wherein said treads and said risers are adapted to extend horizontally between said stringers and to be fastened thereto such that a mounted tread defines a substantially horizontal tread surface and a mounted riser defines a substantially vertical riser surface extending upwardly from an area proximal to a rear end of a lower mounted tread and an area proximal to a front end of an adjacently mounted higher tread, wherein a first flange of said step mounting brackets is adapted to be fastened within a recess provisioned therefor in a longitudinal face of longitudinal ends of both said treads and said risers and wherein a second flange of said step mounting brackets is adapted to be fastened to said stringers.

Still in accordance with the present invention, there is provided a method for erecting a self-standing staircase between an upper structure and a lower structure, the method comprising the steps of:

a. providing a set of step support units, a set of steps, two upper support structures and two lower support structures, said step support units each comprising a first mating structure extending substantially laterally from a first lateral side thereof and a complementary mating structure extending substantially laterally from an opposing lateral side thereof;
b. building two substantially similar stringers by matingly coupling said first mating structure of said step support units with said complementary mating

structure of successive adjacent step support units in a same stringer;

c. respectively coupling said upper support structures and said lower support structures to uppermost and lowermost step support units of each said stringers;
d. respectively mounting said upper and lower support structures to the upper and lower structures; and
e. mounting said steps on said step support units.

Still in accordance with the present invention, there is provided a method for erecting a self-standing curling staircase along a wall defining an outside curl of the staircase between an upper structure and a lower structure, the method comprising the steps of:

a. providing a set of modular step support units, a set of wall mountable step support units, a set of steps, said modular step support units each comprising at least one shaft extending vertically at least partially along a first lateral side thereof and at least one coupling arm extending substantially laterally and horizontally from an opposing lateral side thereof;
b. building a curling stringer by coupling said shaft of said modular step support units with said coupling arm of successive adjacent modular step support units;
c. securing said stringer between the upper and lower structures;
d. mounting said wall mountable step support units to the wall such that once mounted, said wall mountable step support units operate cooperatively with said modular step support units; and
e. mounting said steps on said step support units.

Still in accordance with the present invention, there is provided a method for erecting a staircase between two lining structures, the method comprising the steps of:

a. providing two risers each defined by successive horizontal tread bearing and vertical riser bearing surfaces, a set steps comprising a set of treads and

a set of risers, a set of step mounting brackets, a set of finishing modules and a set of finishing brackets;

b. mounting said stringers to the lining structures;
c. fastening a first flange of said step mounting brackets and a first flange of said finishing brackets within a recess provided therefor in longitudinal ends of said treads and said risers;
d. successively mounting said treads and said risers by respectively fastening a second flange of said step mounting brackets to said tread and said riser bearing surfaces; and
e. inserting said finishing modules between each said step along the lining structures by sliding said finishing modules between said longitudinal ends and a second flange of said finishing brackets.

Other objects, advantages and features of the present invention will become more apparent upon reading of the following non-restrictive description of illustrative embodiments thereof, given by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Having thus generally described the nature of the invention, reference will now be made to the accompanying drawings, showing by way of illustration, illustrative embodiments thereof, and in which:

Figure 1 provides a perspective view of a staircase constructed from a stringer and step support kit in accordance with an illustrative embodiment of the present invention;

Figure 2 provides a perspective view of a step support module from the stringer and step support kit of Figure 1;

Figures 3 and 3A respectively provide a plan and cross sectional view of the alignment of two successive step support modules from the stringer and step support kit of Figure 1;

Figure 4 provides an exploded perspective view of the assembly of a floor support flange to a bottommost step support module from the stringer and step support kit of Figure 1;

Figure 5 provides an exploded perspective view of the assembly of a floor support flange to an uppermost step support module from the stringer and step support kit of Figure 1;

Figure 6 provides an exploded perspective view of the assembly of a step and finishing elements therefor of the stringer and step support kit of Figure 1;

Figure 7 provides a plan view of the assembled stringer and step support kit of Figure 1;

Figures 7A, 7B and 7C provide various cross sectional views of the stringer and step support kit of Figure 7;

Figure 7D provides an alternative cross sectional view of the stringer and step support kit of Figure 7;

Figure 7E provides a cross sectional view of the stringer and step support kit of Figure 6.

Figure 8 provides a perspective view of an alternative staircase constructed from a stringer and step support kit in accordance with an alternative illustrative embodiment of the present invention;

Figure 8A provides a cross sectional view of the finished stringer of the staircase in Figure 8;

Figure 8B provides a cross sectional view of the railing of the staircase of Figure 8;

Figure 9 provides a perspective view of a step support module from the stringer and step support kit of Figure 8;

Figures 10 and 10A respectively provide a plan and cross sectional view of the assembly of two successive step support modules from the stringer and step support kit of Figure 8;

Figure 11 provides an exploded perspective view of the assembly of a floor support structure to a bottommost step support module from the stringer and step support kit of Figure 8;

Figure 12 provides an exploded perspective view of the assembly of a floor support structure to an uppermost step support module from the stringer and step support kit of Figure 8;

Figure 13 provides a perspective view of a further alternative staircase constructed from a stringer and step support kit in accordance with a further alternative illustrative embodiment of the present invention;

Figures 14A and 14B respectively provide an assembled and exploded perspective view of a step support module from the stringer and step support kit of Figure 13;

Figure 15 provides a perspective view of successive step support modules mounted to a floor structure in accordance with the illustrative embodiment of Figure 13;

Figure 16 provides a plan view of the assembly of two successive step support modules from the stringer and step support kit of Figure 13; and

Figures 16A, 16B and 16C provide cross sectional views of the assembled step support modules of Figure 16.

DETAILED DESCRIPTION OF THE ILLUSTATIVE EMBODIMENTS

Referring to Figures 1 to 7, a staircase S, constructed from a stringer and step support kit in accordance with an illustrative embodiment of the present invention, will now be presented. In figure 1, the staircase S is illustratively comprised of a set of steps, as in 12, each comprising a tread 14 and a riser 16 mounted on two lateral stringers, as in 18. The stringers 18, which extend obliquely from a bottom floor (not shown) to an upper floor U, are comprised of individually adjusted modular step supports, as in 20, assembled to form the stringers 18.

Adding reference to Figure 2, the modular step supports 20 are generally constructed of a solid plastic material, or again formed of a cast metal or steel such as aluminium or the like. The step supports 20 are generally defined by a top face 22 for supporting a tread 14 thereon and two parallel lateral faces 25 and 27 extending vertically downwards therefrom and respectively providing a male and a female coupling flange 24 and 26 for connecting successive step supports 20 therewith. The step supports 20 further comprise a structural cross-web 28 for stabilizing and strengthening the support 20 and providing a set of support holes 30 for nailing the step supports 20 to walls, as in W or structures lining the staircase S.

Referring now to Figures 3A and 3B, in conjunction with Figure 2, two step supports 20 are adjustably fastened together by coupling the male and female coupling flanges 24 and 26 of the first and second step supports 20_1 and 20_2 respectively. The male

flange 24 is illustratively comprised of circular holes 32 to be aligned with the rectangular or oblong holes 34 of the female flange 26, thereby providing adjustable means for fastening the two supports together. In this illustrative embodiment, the step supports 20 may be manufactured to provide adjustments ranging between ½ inch and 1 inch in height, thereby allowing the staircase S to be customized according to the specifications of the structures between which the staircase is to be installed. A person of ordinary skill in the art will understand that step supports as in 20 may be modified slightly to provide smaller or greater adjustment ranges without departing from the general scope and nature of the present disclosure.

To fasten the two-step supports 20 together, a set of bolts (not seen) are fitted through the aligned circular and rectangular holes 32 and 34 respectively, and secured using a set of nuts solidly fastened thereto (also not seen). To enhance the solidity and strength of the combined structure, a third bolt, or again a nail or a screw, may be secured though the square hole 36 of the female flange 26 by piercing a matching hole 38 at the bottom of the male flange 24, thereby also securing the adjusted position of mated supports 20.

A person of ordinary skill in the art will understand that other fastening means may also be considered to fasten the step units together. For instance, the circular holes 32 could be threaded and the fastening bolts could be fastened therein to provide a secure juncture. Alternatively, the circular holes 32 could be replaced with bolts integrally coupled to the male flange 24 and extending outwardly therefrom to be guided through the oblong holes 34 of the female flange 26 and secured therein using a set of nuts. Additionally, an intermediary mating member could be inserted between each mating flange pair to enhance the coupling thereof. Further fastening and coupling means and techniques may also be considered without departing from the general scope and nature of the present disclosure.

Referring back to Figure 1, the staircase S is constructed by first building and mounting the stringers 18. As discussed hereinabove with reference to Figures 3A and 3B, the

individual step supports 20 are adjustably coupled together using a set of bolts and securing nuts. Other fastening means may also be considered in this step without departing from the general scope and nature of the present disclosure. Once formed, the stringers 18 are mounted to the walls, as in W, or structures (e.g. wall studs) lining the staircase S by fastening the stringer 18 thereto using nails or screws through the holes 30 provisioned therefor.

Adding reference to Figure 4 in conjunction with Figure 1, the female flange 26 of the bottommost step support 20_B is fitted with a support flange 40 for securely coupling the bottom of the staircase S to the lower floor framework (not show). As with coupling two step supports 20 together, the male support flange 40 is adjustably fastened to the female coupling flange 26 by aligning the circular holes 42 of flange 40 to the rectangular or oblong holes 34 of coupling flange 26, and fastening two bolts 44 therethrough using nuts 46. As a result, the forward facing lip 48 of the support flange 40 may be fastened to the floor framework (not shown) using a set of screws, nails and other such fastening means, thereby securing the bottom of the staircase S thereto. Furthermore, to increase the stability and strength of the juncture, a third bolt, or again a nail or screw, may be secured though the square hole 36 of the coupling flange 26 by piercing a matching hole 50 in the support flange 40, thereby also securing the adjusted position thereof.

Referring now to Figures 5 and 1, the male flange 24 of the uppermost step support 20_U is fitted with a support flange 52 for securely coupling the top of the staircase S to the upper floor frame work, illustrated here as a floor support beam 54. At this extremity, the female support flange 52 is adjustably fastened to the male coupling flange 24 by aligning the circular holes 32 of coupling flange 24 to the rectangular or oblong holes 56 of flange 52, and fastening two bolts 58 therethrough using nuts 60. As a result, the backward facing lip 62 of the support flange 52 may be fastened to the upper floor framework, as in floor support beam 54. Furthermore, to increase the stability and strength of the juncture, a third bolt, or again a nail or screw, may be secured though the square hole 64 of the support flange 52 by piercing a matching hole 66 in the coupling flange 24, thereby also securing the adjusted position thereof.

Once both stringers 18 are securely in place, thereby providing a solid framework for the staircase S, the various components of the steps, as well as any finishing components enhancing the aesthetic value of the staircase S may be coupled thereto. As will become apparent to a person of ordinary skill in the art, the staircase S may also be constructed progressively, laying every step in a successive or predefined order.

Referring now to figures 1, 6 and 7, the staircase S generally comprises a set of steps 12 each comprising a tread 14 defining the generally horizontal top face of the step 12 and a riser 16 extending substantially vertically upward from the back thereof. In addition, a set of wall covers 66, of substantially triangular shape, are fitted along the sides of the staircase S to provide a finished look by hiding the gap between the walls W running along the staircase S and the steps 12 and by covering the hardware used to construct the staircase S. A border or moulding 67 may also be included to run obliquely along the staircase S to cover the joints between successive wall covers 66, to hide any gap left between the wall covers 66 and the wall W to which is mounted the staircase S, and thus to provide a finished look. Additional finishing pieces may also be included to hide the inner faces of the step supports 20. For instance, as will be discussed further hereinbelow with reference to Figure 7E, a substantially triangular board 69 may be fitted on the inner faces of each support 20 thereby hiding part of same from view. A running board 71 extending the length of the modular stringer 18 and fitted below the boards 69 can complete the masking effect.

To mount the various staircase components, a series of L-shaped brackets 68 and J-shaped brackets 70 are first fitted to the treads 14 and risers 16. The brackets 68 and 70, which may be manufactured of a hard plastic, a metal, or any substantially rigid material, are used to fasten the treads 14 and risers 16 to the stringers 18 and provide means for coupling the wall covers 66 thereto.

With specific reference to Figures 7 and 7A the L-shaped brackets 68 are generally comprised of a first flange 72 and a second flange 74 extending substantially normal thereto. Each

flange respectively comprises a recessed fastening hole 76 and 78. The first flange 72 is fastened within a recess 80 in the side walls of the treads 14 and risers 16 using a screw or nail through hole 76, whereas the second flange 74 is subsequently fastened to the step supports 20. To provide a better finish, the recessed fastening holes 76 and 78 are such that once a bracket flange is fastened, the head of the fastening screw used therefor is flush therewith.

With specific reference to Figures 7, 7B and 7C, the J-shaped brackets 70 are generally comprised of two parallel flanges and a curved or squared member generally substantially normal thereto and joining the two. The parallel flanges illustratively include a shorter fastening flange 82 and a longer stabilizing flange 84. A recessed fastening hole 86 in the fastening flange 82 allows a screw to fasten the J-shaped bracket 70 within a recess 80 in the side walls of the treads 14 and risers 16, whereas a hole 88 in the stabilizing flange 84 allows the fastening screw to pass fully therethrough and provides access thereto for the fastening thereof. Again to provide a better finish, the recessed fastening holes 86 is such that once a bracket flange 82 is fastened, the head of the fastening screw used thereof is flush therewith.

Referring back to Figure 6 in conjunction with Figures 7, 7A, 7B and 7C, an L-shaped bracket 68_R and a J-shaped bracket 70_R are illustratively fastened to a riser 16. The riser is then positioned on the stringer 18 such that the bottom face 90 of the riser 16 rests on the top surface 22 of the step support 20_1. The riser 16 can then be fastened to the lateral face 27 of step support 20_2 using the second flange 74 of the L-shaped bracket 68_R extending sidewardly therefrom.

Once the riser 16 is secured into place, an L-shaped bracket 68_T and two J-shaped brackets 70_T are fastened to the side wall of the tread 14. The tread is then positioned on the stringer 18 such that the back face 92 of the tread 14 abuts on the front face 94 of the riser 16 and such that the bottom face 96 of the tread 14 rests on the top face 22 of support 20_1. The tread 14 is then fastened to the support 20_1 using the second flange 74 of the L-shaped bracket 68_T extending sidewardly therefrom. The same procedure can then be repeated for every successive step 12. As for the uppermost riser

16_U, the brackets 68 and 70 may be fastened directly in the upper floor structure U.

To accommodate various wall imperfections, the L-shaped brackets 68 provide a lateral adjustment range, thereby allowing the steps 12 to be adjusted accordingly between the stringers 18. As will be discussed further hereinbelow, the lateral adjustment range depends on the actual width of the modular supports 20 to which are fastened the brackets. Illustratively, the lateral adjustments may range between ¼ inch and ½ inch, though larger or smaller ranges may be considered by modifying the width of the supports 20. Alternatively, the L-shaped brackets 68 could comprise an oblong hole 78 rather than a circular hole, thereby providing a similar feature.

Still referring to Figures 6, 7A, 7B and 7C, the substantially triangular wall covers 66, each generally comprising a vertical edge 98, a horizontal edge 100 and an oblique edge 102, are slid into place between the parallel flanges 82 and 84 of the J-shaped brackets 70 such that the vertical and horizontal edges 98 and 100 abut on the curved or squared member of the J-shaped brackets 70 and on the second flange 74 of the L-shaped brackets 68. By proper selection of the depth of the recess 80 within the side walls of the treads 14 and risers 16, the wall covers 66 may be fitted within the J-shaped brackets 70 such that the wall covers 66 are flush against the tread and riser sidewalls. Consequently, the wall covers 66 will not only be stabilized between the two parallel flanges of the J-shaped brackets 70 but will also bear against the tread and riser sidewalls. Using this method, every bracket is fully covered and hidden by the treads 14, risers 16 and wall covers 66.

Due to the adjustability of the riser heights, namely by adjusting the coupling of the step supports 20, the wall covers 66 may be correspondingly shifted, thereby producing an undesirable visual effect. To address this effect, a border or moulding 67 may be fitted on top of the wall covers 66. As illustrated in Figures 7A, B and C, the moulding generally comprises a coupling end 104 defining a recess 106 for accepting the oblique edge 102 of the wall covers 66 therein. If the wall W to which is mounted the staircase S is perfectly flat, the moulding 67 may be fitted perfectly vertically to the wall

cover 66. On the other hand, if the wall W is not perfectly flat, the steps 12, and consequently the wall covers 66, may not necessarily be flat against the walls W.

Generally, the step supports 20 will allow a step 12 of standard width to be fastened thereto with a certain margin of flexibility, namely governed by the thickness of the step supports 20 to which will be fastened the steps 12. Namely, as presented hereinabove, lateral adjustments ranging between a quarter (¼) and a half (½) inch are provided by the illustrated supports 20. By varying the thickness of the supports 20, smaller or greater ranges may be considered. Brackets 68 with oblong rather than circular holes 78 could also provide a similar advantage.

Consequently, adding reference to Figures 7D and 7E, the moulding 67 and wall covers 66 should provide slightly rounded coupling edges. A rounded wall cover edge 102 and a rounded moulding recess 106, allows the moulding 67 to be fitted at a slight angle to the wall covers 66, thereby absorbing the imperfections in the walls W, as illustrated by the space 107 left between the moulding 67 and the wall W in Figure 7D. Once positioned, the moulding is nailed, screwed and/or glued into the walls W thereby lining the staircase S and providing a finished look.

Referring now to Figures 6 and 7E, the staircase S may also comprise additional components to better hide the hardware used therefor. For instance, as briefly discussed hereinabove, a triangular board 69 may be positioned below each tread 14 on the inner face of each support 20. A running board 71 extending the length of the modular stringer 18 and fitted below the boards 69 can complete the masking effect.

To install these components, the boards 69 may first be glued to the supports 20. A Z-shaped bracket 115 is then nailed to the bottom inside face of the running board 71. The running board 71 is then fitted below the boards 69 by sliding the tongue 109 lining the bottom of the boards 69 into the groove 111 lining the top of the running board 71 and resting the Z-shaped bracket 115 against the wall W. A set of finishing nails 113 are used to secure the juncture between the boards 69 and the running board 71, and a bottom moulding 117 is nailed at an angle below the running board 71 to

hide the space between same and the wall W and hide the Z-shaped bracket 115 therebehind.

As presented hereinabove with reference to Figures 1 to 7, the staircase S is constructed such that all the mounting and structuring hardware is covered and hidden once the staircase S is complete. Additionally, the staircase may be fully constructed and customized on site, as all pieces are adjustable and designed to provide a customizable staircase S. Furthermore, no special tools are required to mount the staircase. Ultimately, a single screwdriver may suffice to fasten all the required components.

As will now be apparent to a person of ordinary skill in the art, other masking means may be employed to cover and hide the staircase hardware and wall imperfections without departing from the general scope and nature of the present embodiment. Furthermore, various fastening means, such as bolts, screws, nails and glue may be used alone or in combination to fasten the various components in the kit. In addition, the staircase S may also be fully constructed prior to installation, leaving only possibly a few aesthetic components to be installed once the staircase is put in, such as the wall covers 66 and mouldings 67.

In addition, various materials may be considered for the manufacture of the various staircase components. Namely, the treads 14, risers 16, covers 66 and mouldings 67 may each be manufactured of varying hardwoods, softwoods, composite materials and/or plastics and provide varying finishes. Since all the hardware is adequately hidden by these components, damage to the finished surfaces is avoided. Alternatively, unfinished materials may also be used for the subsequent painting or covering thereof.

Referring now to Figures 8 to 12, an alternative staircase S' constructed from a stringer and step support kit in accordance with an alternative illustrative embodiment of the present invention will be presented. In Figure 8 a free standing staircase S' is designed to be mounted without resting on side walls or structures. Generally, the staircase S' will rest on a bottom structure, illustrated here as single blocks 108, and an upper structure, illustrated here as single blocks 110. The blocks 108 and 110 generally represent any solid structures such as floor or wall structures including, but not

limited to, a floor beam or joist, or any other such solid structure.

The staircase S' is illustratively comprised of a set of steps, as in 112, mounted on two lateral stringers, as in 114. The stringers 114, which extend obliquely from the bottom structure 108 to the upper structure 110 are comprised of individually adjusted modular step supports, as in 116 assembled to form the stringers 114. As will become apparent to a person of ordinary skill in the art, though the steps 112 of the alternative staircase S' do not comprise risers per say, risers could just as well be included in the general construction of the staircase S' without departing from the general scope and nature of the present embodiment.

Adding reference to Figure 9, the modular step supports 116 are generally manufactured of a solid cast metal or steel such as aluminium or the like. The step supports 116 are generally defined by parallel top and bottom oblique faces 118 and 119 respectively and two parallel lateral faces 120 and 121 extending substantially vertically therebetween and respectively providing a male and a female coupling flange 122 and 124 for connecting successive step supports 116 therewith. The step supports 116 further comprise a structural crossbar 126 for stabilizing and strengthening the support 116, and inherently, the staircase S', and two step fastening holes 127 for fastening the steps 112 thereto.

Referring now to Figures 10 and 10A, in conjunction with Figure 9, two step supports 116 are adjustably fastened together by coupling the male and female coupling flanges 122 and 124 of the first and second step supports 116_1 and 116_2 respectively. The male flange 122 is illustratively comprised of circular holes 128 to be aligned with the rectangular or oblong holes 130 of the female flange 124, thereby providing adjustable means for fastening the two supports together. Namely, the step supports 116 may be manufactured to provide adjustments ranging between a half (½) inch and one (1) inch in height, thereby allowing the staircase S' to be customized according to the specifications of the structures between which the staircase is to be installed. A person of ordinary skill in the art will understand that step supports as in 116 may be modified slightly to provide smaller or greater adjustment ranges

without departing from the general scope and nature of the present disclosure.

To fasten the two step supports 116 together, a set of bolts 132 are fitted through the aligned circular and rectangular holes 128 and 130 respectively, and secured using a set of nuts 134 solidly fastened thereto. For a smoother finish, the fastening holes 128 and 130 may be recessed such that the bolts and nuts do not extrude significantly from the plane of the supports 116. To enhance the solidity and strength of the combined structure, a third bolt may be secured though the square hole 136 of the female flange 124 by piercing a matching hole 138 at the bottom of the male flange 122.

Referring back to Figure 8, the staircase S' is constructed by first building and mounting the stringers 114. As discussed hereinabove with reference to Figures 10 and 10A, the individual step supports 116 are adjustably coupled together using a set of bolts 132 and securing nuts 134. As discussed hereinabove with reference to staircase S, other fastening means may also be considered in this embodiment without departing from the general scope and nature of the present disclosure. Once formed, the stringers 114 are ready to be mounted on the bottom and upper structures 108 and 110.

Adding reference to Figure 11 in conjunction with Figure 8, the female flange 124 of the bottommost step support 116_B is fitted with a support structure 140 for securely resting the bottom of the staircase S' to the lower structure 108. As with coupling two step supports 116 together, the support structure 140, comprising a male flange 142 for mating with the female flange 124 of the support 116_B, is adjustably fastened thereto by aligning the circular holes 144 of flange 142 to the rectangular or oblong holes 130 of coupling flange 124 and fastening two bolts 146 therethrough using nuts 148. As a result, the forward facing foot 150 of the support structure 140 may be rested on the bottom structure 108, thereby securing the bottom of the staircase S' thereon. Furthermore, to increase the stability and strength of the juncture, a third bolt may be secured though the square hole 136 of the coupling flange 122 by piercing a matching hole 152 in the support structure 140.

Referring now to Figures 12 and 8, the male flange 122

of the uppermost step support 116_U is fitted with a support structure 154 for securely resting the top of the staircase S' to the upper structure 110. At this extremity, the support structure 154, comprising a female flange 156 for mating with the male flange 122 of the support 116_U, is adjustably fastened thereto by aligning the circular holes 128 of coupling flange 122 to the rectangular or oblong holes 158 of flange 156 and fastening two bolts 160 therethrough using nuts 162. As a result, the backward facing foot 164 of the support structure 154 may be rested on the upper structure 110, thereby securing the top of the staircase S' thereon. Again, to increase the stability and strength of the juncture, a third bolt may be secured though the square hole 166 of the support structure 154 by piercing a matching hole 168 in the coupling flange 122.

Once both stringers 114 are securely in place, thereby providing a solid framework for the staircase S', the various components of the steps, as well as any finishing components enhancing the aesthetic value of the staircase S' may be coupled thereto. As will become apparent to a person of ordinary skill in the art, the staircase S' may also be fully constructed prior to installation without departing from the general scope and nature of the present disclosure.

Referring now to Figures 8, 11 and 12, the staircase S' generally comprises a set of steps 112. The steps 112 illustratively comprise a solid core 163 which may be manufactured of solid wood, particle board, a set of layered and glued particle boards, or other such materials. At each longitudinal end thereof, a plastic cap 165 is solidly fixed thereto possibly using a strong adhesive or glue. The core 163 of the steps 112, and the peripheral edges 167 of the plastic caps 165, are then covered by a protective sheet 169, such as a galvanised steel sheet, that is wrapped around the step's core 163 through high tension lamination using an asphaltic adhesive or other such adhesives and further secured thereto by a set of nails or screws 171 secured thereunder. Once fabricated, the steps 112 are generally waterproof, that is that no water may attack the wood or particle board core, and substantially fireproof. Furthermore, by using a high tension lamination method, the steps gain a high structural resilience adequate for any industrial, commercial or even

residential use wherein safety, durability, sturdiness and even fireproofness is desired or even required by building codes. The use of a galvanised steel layer, which may comprise of a steel sheet of 16 to 30 gauge, or again any gauge desired or deemed necessary for the application at hand, enhances the durability of the steps and reduces the occurrence of rust or corrosion of the step surface. Ultimately, based on the application and need of the user, other steps may also be considered in the present embodiment without departing from the general scope and nature of the present disclosure.

Still referring to Figures 8, 11 and 12, the steps 112 are fastened to the step supports 116 using a set of L-shaped brackets 170, each comprising a threaded vertical flange 172 for the fastening thereof to the supports 116 and a horizontal flange 174 for the fastening thereof to the bottom of the steps 112. To mount the steps 112, the L-shaped brackets 170 are first fastened to the step supports 116 using a set of bolts 173 securely fastening the threaded vertical flanges 172 thereof to the fastening holes 127. Subsequently, each step 112 is successively fastened on top of the horizontal flanges 174 using a set of screws (or nails) 175 that pierce the outer shell 169 of the steps 112 and lodge within the solid core 163. Alternatively, the L-shaped brackets 170 are first secured to the bottom of the steps 112, and the steps are subsequently secured to the stringers 114 using the brackets 170 fastened thereon and a set of bolts 173 coupled therewith through the stringer holes 127.

A person of ordinary skill in the art will understand that other mounting and fastening means may be employed without extending the general scope and nature of the illustrative embodiment. For example, alternative brackets may be used to provide lateral adjustability to the steps 112. Furthermore, the use of additional brackets may increase the strength and stability of the steps 112. Finally, the steps 112 may be manufactured of any solid material such as hard plastics, wood, metal and steal. The steps may also be covered with paint or carpet, or again present a rugged or textured surface for increased grip. Finally a set of risers may also be coupled to the staircase S' using an additional set of brackets 170 fitted to the step supports 116, or other such fastening means.

Additionally, still referring to Figures 8, 11 and 12, the staircase S' may further comprise one or two railings 176. The railings, each illustratively comprising a set of vertical bars 178 and an oblique bar 180 lining the edge of the staircase S', are fastened to the top oblique edges 118 of the step supports 116. As seen in Figures 11 and 12, the vertical bars 178 are fastened at one end to the step supports 116 using a fastener such as a screw or bolt, and fastened at the other end, as seen in the cross section of Figure 8C, to the oblique bar 180. Other fastening configurations and methods may also be considered without departing from the general nature of the illustrated embodiment. Namely, the vertical bars 178 could be fastened to the inside or outside face of the step supports 116 rather than to their upper edges 118. Furthermore, though the railing bar 180 of the illustrated embodiment is hollow, any type of railing bar, whether it be hollow, full, metallic or manufactured of wood and/or plastic, may be considered, though metallic railings should be used if a fireproof staircase S' is desired or required by commercial or industrial building codes.

Referring now to Figures 8 and 8B, the stringers 114 may also be covered with an aesthetic sheeting or mould 182 to cover the generally industrial look of the step supports 116 and hardware. As seen in Figure 8 and in the cross section of a stringer 114 in Figure 8B, two lateral covers 184 are first fixed to the step supports 116, either using screws, bolts or other such fasteners, or again using a type of glue or adhesive. Top and bottom caps 186 are then added to the structure to complete the cover. Generally, the installation of the sheeting 180 may be facilitated if done prior to mounting the steps 114 to the stringers 112. Holes needed to fasten the step hardware may be pierced through the aesthetic sheeting 182.

Various fastening means may be utilised to mount the aesthetic sheeting 182 to the staircase S'. Namely, a set of hardware clips and brackets may be fastened to the step supports 116 to hold the sheeting thereon. Alternatively, the sheeting 182 may also be glued onto the step supports 116.

Referring now to Figures 13 to 16, a further alternative staircase S'' constructed from a stringer and step support kit in

accordance with a further alternative illustrative embodiment of the present invention will be presented. In Figure 13 an adjustable spiralling or curling staircase S" is illustratively comprised of a set of steps, as in 184, each illustratively comprising a tread 186 and a riser 188, mounted helicoidally within a rounded wall W". Unlike a linear staircase, such as staircases S and S', the staircase S" is not mounted on two collinear stringers. In this illustrative embodiment, the staircase S" is mounted on a set of wall-mounted step supports 190 and a corresponding set of successively mounted adjustable modular step supports 192.

Adding reference to Figures 14A and 14B, the adjustable modular step supports 192 are generally manufactured of a solid cast metal or steel such as aluminium or the like, though hard plastics may also be considered. The step supports 192 are generally comprised of a substantially rectangular upper section 193 and a tapered lower section 194 extending vertically downward therefrom. The upper sections 193 generally comprise a top face 195 on which may be installed the treads 186, a substantially flat lateral face 196 extending generally vertically downward therefrom upon which may be mounted the risers 188 and a set of extending arms 198 adjustably fastened thereon. The lower sections 194 generally comprise a substantially planar member comprising a tubular lateral edge 199, and two cutouts 200 thereby defining two cylindrical shafts 201. As will be discussed further hereinbelow, the set of extending arms 198 of a lower step support 192 are configured to be adjustably and pivotally fastened to respective cylindrical shafts 201 of an adjacent upper step support 192. Consequently, a spiralling stringer may be constructed by the successive coupling of the modular step supports 192.

Adding reference to Figure 15, the bottommost step support 192_B should be fastened to a structural component of the bottom floor F from which the staircase S" is extending. Illustratively, this structure is represented by a structure block 202 which could, for example, be part of a floor joist or beam or a wall stud. To fasten the bottommost step support 192_B to the structure block 202, a set of two joints 204 are pivotally coupled to the cylindrical shafts 201 thereof. The joints 204, each generally comprising two substantially

identical members fastened together by a set of nuts and bolts 206, define a cylindrical opening 208 for accepting and retaining the cylindrical shafts 201 therein. The joints 204 further comprise a foot end 210 allowing for the fastening thereof to the block 202 using a set of screws or bolts 212, thereby securing the joints 204 and consequently the bottommost step support 192_B thereto. As will be apparent to a person of skill in the art, a similar joint system may be used to secure the uppermost step support 192_U to an upper floor structure (not shown). Ultimately, these upper floor joints would illustratively provide two cylindrical shafts for coupling the extending arms 202 of step support 192_U thereto, and foot ends for the fastening thereof to the upper floor structure.

Still referring to Figures 13 to 15, the extending arms 198 of the step supports 192 are each generally comprised of two substantially identical members 214 designed to hold a respective cylindrical shaft 201 of a subsequent upper support 192 therebetween. The members 214, positioned on each side of the upper section 193 of the step support 192, are adjustably fastened thereto and define cylindrical openings 216 at a distal end thereof for accepting the cylindrical shafts 201 of a subsequent support 192 therein. At a proximal end of the arms 198, a set of bolts 220 are fed through rectangular or oblong slots 222 in each member 214 aligned with a set of circular holes 224 in the upper end of the step holder 192. At the distal end of the arms 198, another bolt 226 is fed through a circular hole 228 at the end of each member 214. Once the arms 198 are properly positioned, the bolts are then securely fastened using a set of nuts 230, thereby securing the arms 198 in place and, when coupling two supports 192 together, holding the cylindrical shafts 201 of the subsequent support 192 therein.

Referring now to Figure 16, two coupled step supports 192_1 and 192_2 are adjustably fastened together. As illustrated by the phantom lines of this figure, the vertical alignment between subsequent step supports 192 may be selected by adjusting the height along the cylindrical shafts 201 of the upper support 192_2 at which the extending arms 198 of the lower support 192_1 are coupled. Illustratively, the vertical adjustment range is defined by the height of the extending arms 202 relative to the height of the cutouts 200. In

this illustrative embodiment, an adjustment range of a half (½) inch to one (1) inch is available to the coupled supports 192. By increasing the height of the cutouts 200, or by reducing the height of the arms 202, one may increase that range accordingly.

Adding reference now to Figures 16A and 16B, cross sections of Figure 16 are presented. In these cross sections, the horizontal alignment between the step supports 192 is adjusted by sliding extending arms 198_1 of lower support 192_1 using the rectangular or oblong slots 222_1 therein and thus adjusting the reach of the arms 198_1. In Figure 16A, the arms 198_1, securing the shafts 201_2 therein, are at their shortest extension length thereby providing a shallow step depth. In Figure 16B, the arms 198_1, still securing the shafts 201_2 therein, are at their longest extension length thereby providing a deep step depth. Illustratively, the horizontal adjustment range is selected between 1 to 2 inches to provide adequate customizability for a variety of stairwell configuration. Ultimately, smaller or greater adjustment ranges may also be considered by altering the length of the arms 198 and the rectangular or oblong holes 222 therein.

Adding reference now to Figure 16C, an alternative cross sectional view of Figure 16 is presented. In this Figure, the angle between the step supports 192 is varied by pivoting the cylindrical shafts 201_2 of the upper support 192_2 within the cylindrical cavity 218_1 defined by the extending arms 202_1 of the lower support 192_1. Generally, by pivoting the upper support 201_2 with regards to the lower support 201_1, the supports 201 may successively define the spiral nature of the staircase S''. Additionally, due to great range of motion provided to the supports 192 by the coupling of the cylindrical shafts 201 and cavities 218 of successive lower supports 192, a stringer for staircase S'' may be constructed of various segments including spiralling, turning and straight segments.

From the above illustrations, it will now be apparent to a person of ordinary skill in the art that various step lengths, heights, rotations and consequently, various staircase pitches may be obtained with these adjustable modular step supports 192. Furthermore, though the illustrated

Referring back to Figure 13, as the step supports 192

are interconnected and adjusted according to a predefined staircase design considering step height, length and pitch, corresponding wall-mounted step supports 190 may be fastened to the wall W". For instance in Figure 13, the supports 190 generally comprise L-shaped brackets comprising a first horizontal flange for the fastening thereof to the wall W" and a second horizontal flange for the fastening thereof to the underside of the treads 188. Additional riser supports (not seen), possibly substantially similar to the step supports 190, may also be coupled to the wall W" for securing the risers 188 thereto.

Consequently, the steps may be constructed on the wall-mounted tread and riser supports 190 and the modular step supports 192. Risers will be secured to the lateral faces 196 of the supports 192 and correspondingly to the riser supports. As for treads 186, they will be secured to the top faces 195 of the supports 192 and the wall-mounted supports 190. To mount the risers 188 and treads 186, various clips and brackets, as used in the construction of staircases S and S', may also be used to provide versatility in the construction of staircase S". For instance, by using L-shaped brackets in this alternative embodiment, the steps may also be adjusted laterally to accommodate various imperfections in the staircase materials or structures on which the staircase S" is mounted. Furthermore, by incorporating J-shaped brackets, or other such brackets to the risers 188 and treads 186, or again directly to the modular step supports 192, various ornamental and aesthetic features may be added to the staircase S", namely borders, mouldings and other such elements.

Alternatively, as illustrated for staircase S', various ornamental sheetings or covers may be fastened of glued to the supports, thereby also providing a finished look. Additionally, a railing may also be added to the staircase S" by the coupling thereof to the modular brackets 192, or again to the treads 186 or risers 188 directly.

As will be apparent to a person of ordinary skill in the art, the staircase S" is completely customizable and mountable on site with a minimal amount of tools. For instance, even if the staircase is not designed in advance, the modular supports 192 may

be adjusted on site to accommodate the specific configuration of the stairwell, and the wall-mounted supports, which may include L-shaped brackets as in 190, a one-piece or a modular stringer, or other such mounting means, may be secured to the wall W" to correspond therewith. The treads 186 and risers 188 may then be cut to size on site. Alternatively, the staircase S" will be designed in advance, and parts may be brought in for a direct fitting in the stairwell. Also, the staircase S" may be fully manufactured prior to installation. Again, finishing touches such as wall covers and mouldings may be added to cover the hardware and spiral stringer of the staircase S" using various clip and bracket systems such as discussed hereinabove with reference to staircase S and the Figures related thereto. Furthermore, various building materials such as hard and soft woods, finished or unfinished, as well as covered and uncovered metals and plastics may all be considered to construct the staircase S".

As illustrated in the above Figures, adjustable modular stringer and step support kits may be used to construct staircases ranging from linear industrial and residential staircases, to spiralling and customized staircases. Each configuration providing options on adjustability and finish.

It is to be understood that the invention is not limited in its application to the details of construction and parts illustrated in the accompanying drawings and described hereinabove. The invention is capable of other embodiments and of being practised in various ways. It is also to be understood that the phraseology or terminology used herein is for the purpose of description and not limitation. Hence, although the present invention has been described hereinabove by way of illustrative embodiments thereof, it can be modified, without departing from the spirit, scope and nature of the subject invention as defined in the appended claims.